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A Study of the Apple Pistol-Case Bearer and its Allies in Nova Scotia (Lepidoptera, Coleophoridae)

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Through H. D. Pickett of the Dominion Experimental Farm at Kentville, Nova Scotia, a long series of a coleophorid bred from pistol cases on apple has been received with a request for identification. The species has long been known to occur in the orchards of the Annapolis Valley, and the name *atlantica* Heinrich has been tentatively applied to it, pending a more intensive study of its various taxonomic features, especially with reference to the genitalia of both sexes. This has now been made possible owing to the adequate number of specimens available for such an investigation.

The species belongs in a small group in which the primaries are largely white, with a scattered dusting of smoky brown atoms, most prevalent along the costa and towards the apex of the wing. The palpi are short, white, with a faint smoky tinge outwardly at the base. The long hair tuft on the basal antennal joint, characteristic of all the pistol-case group, is also white, tinged with smoky on the under side. The antennae are, to a varying degree, annulate with brown. The secondaries are smoky brown, with paler fringes which match in color those of the primaries. Several species with this type of maculation have been described, and superficially they bear such a close resemblance to one another as to render a definite determination on mere color and maculation almost impossible; even in the genitalia the

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differences are slight and must be most carefully evaluated by a study of as long a series of slides as possible. The named species involved is *atlantica* Heinrich, an eastern North American species, described largely from specimens bred from pistol cases at Falls Church, Virginia, on black cherry (*Prunus serotina*). Also in the same group are two European species, *anatipennella* Hübner and *albidella* Herrich-Schaeffer, the latter formerly considered as a mere variety but later established as a good species on account of its different habitat and certain minor genitalic characters.

Of primary importance in the investigation was the necessity of establishing as accurately as possible the specific genitalic characters of *atlantica*. In this connection Dr. J. F. Gates Clarke of the United States National Museum in Washington was most helpful; he supplied on loan a slide of the male organ of one of the bred paratypes from Falls Church and also donated to the author a female paratype from East Aurora, New York (W. Wild). This material was augmented by another female paratype, collected at Washington, D. C., by A. Busck, from the Canadian National Collection at Ottawa as well as one of the original pistol cases. Through Mr. J. D. Bradley of the British Museum (Natural History) a loan was effected of a male and two females of *anatipennella* and a male of *albidella*, with permission to make genitalic slides. Dr. T. N. Freeman kindly sent for study from the Canadian National Collection a good series of specimens bred at various times during the present author's employment at Ottawa from pistol cases occurring mostly on willow (*Salix bebbiana*) and occasionally on poplar. Those cases had been collected largely in the Ottawa district and in southern Ontario but included also specimens from Prince Edward Island (Brackley Beach), Cape Breton Island (Baddeck), and the Gaspé Peninsula, Quebec (Cascapedia); such material had also been tentatively placed as *atlantica*. In the collection of the Nova Scotia Museum of Science are four male specimens collected at light by D. Ferguson at Glenville, Cumberland County, Nova Scotia, and a single male from Caraquet, Gloucester County, New Brunswick.

With such material available for genitalic preparations, although rather scanty in certain respects, it has been possible to arrive at a fairly satisfactory conclusion regarding the salient specific characters of the species involved. The apple feeder has been found to differ quite considerably in genitalia from the willow feeder, so that, even when individual variation is allowed for it has proved impossible to place both under one specific heading. The genitalia of the apple feeder, in both sexes, matches very closely those of *anatipennella*, while the wil-

low feeder shows a very definite relationship with *atlantica*, which, in its turn, appears to have a closer connection with *albidella* than with *anatipennella*. In the light of present knowledge it seems advisable to consider the pistol-case bearer on apple in Nova Scotia as identical with the European *anatipennella* and to place the willow feeder under *atlantica* which is considered as distinct from *albidella*. A more detailed discussion of these two species is given in the following sections. It might be well to mention at this point that the name *malivorella* was given by Riley (1878, Ann. Rept. Comm. Agr., Washington, pp. 208, 253, pl. 7, fig. 1) for a pistol-case bearer found in apple orchards in New York State and Pennsylvania. The original description has not been available but Lintner (1882, First Ann. Rept. State Ent., New York, p. 163) gives a reproduction of Riley's figure, to judge by which the primaries of the adult are much more heavily suffused with smoky atoms than is the case in the above-mentioned species. Similar reproductions are given by Saunders (1883, Insects injurious to fruits, p. 115) and by Sanderson (1913, Insect pests of farm, garden and orchard, p. 618). The heavy suffusion of the primaries, especially in the male sex, is noted by Lowe (1897, Bull. New York Agr. Exp. Sta., no. 122) and mentioned by myself ("1944" [1945], Canadian Ent., vol. 76, p. 238). Unfortunately no material has been available for dissection, and the exact relationship of the species must remain in abeyance for the present.

Coleophora anatipennella Hübner

Tinea anatipennella HÜBNER, 1796, Sammlung Europäischer Schmetterlinge, Tineae, vol. 5, pl. 27, fig. 186.

Coleophora anatipennella, STAINTON, 1859, Natural history of the Tineina, vol. 4, p. 166, pl. 4, fig. 3. BARASCH, 1934, Deutsche Ent. Zeitschr., p. 41, pl. 2, fig. 10 (male genitalia). BENANDER, 1939, Opuscula Ent., p. 73, pl. 2, fig. 38. HACKMAN, 1945, Notulae Ent., pp. 4, 42, pl. 9, fig. 87 (female genitalia).

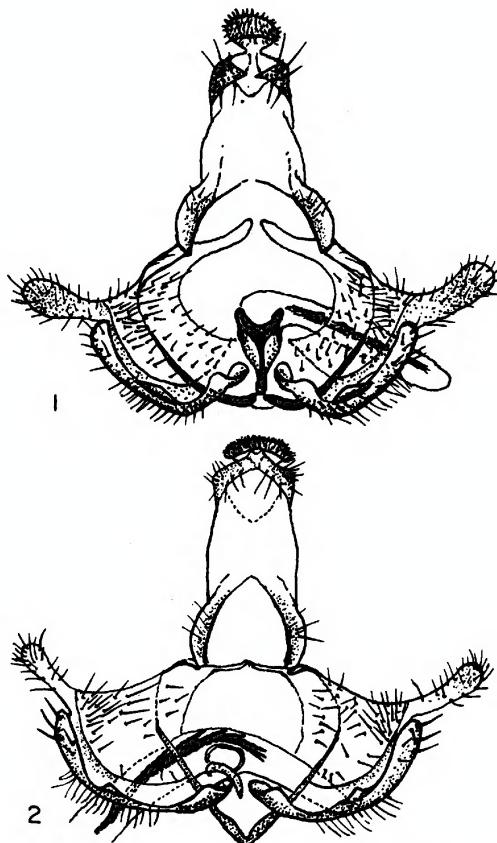
Eupista albidella, PIERCE (nec Herrich-Schaeffer), 1935, The genitalia of the British Tineina, p. 62, pl. 37 (misidentification).

Eupista anatipennella, TOLL, 1952, Eupistidae of Poland, p. 116, pl. 8, fig. 68 (male genitalia), pl. 25, fig. 226 (female genitalia), pl. 35, fig. 66 (pistol case).

The above bibliography is by no means complete but includes merely the most important references to recent European articles on the subject, with particular reference to genitalic figures. In this connection it should be noted that Pierce's figures are the direct reverse of those given by Toll which, judging by the author's dissections, appear to be correct. None of the figures, especially those of the female organ, are entirely satisfactory, as the finer details have been unfortunately

omitted. Toll, in his description of the male genitalia which is largely comparative with those of *albidella*, notes that the "ventrocaudal process of the sacculus reaches up to the valve" and that it has at its base "a lumpy thickening, the apex of which is slightly thickened and rounded." In *albidella*, on the contrary, the sacculus process "does not reach up to the valve," and the "lumpy thickening at the base of the process is much higher." These characters, especially the latter, are evident in his figures and can also be noted in Pierce's figures, if his terminology be reversed.

In the female genitalia Toll's figure is less satisfactory as the ostium, as delineated, is much too narrow; in this respect Pierce's figure (as *albidella*) is more correct and in accordance with the present author's



Figs. 1-2. Male genitalia of *Coleophora*. 1. *C. anatipennella* Hübner. 2. *C. atlantica* Heinrich.

preparations. The main distinction is found in the genital plate, the lateral angles of which are more or less squarely cut and not strongly rounded as in *albidella*. Certain differences are also noted in the shape of the signum but, without a slide of the organ in *albidella*, no comment can be made as to this statement. Nothing is said regarding the length of the spiculate section of the ductus bursae, but it would appear, as far as the author can judge by the two dissections before him, to be subject to considerable variation. A figure is given (fig. 5) of the female organ taken from one of the British Museum specimens from Basle, Switzerland.

In regard to our Nova Scotia apple feeder, considerable variation has been noted in the amount of dark dusting on the primaries of the adult, some specimens being almost pure chalky white. In all cases the antennae are *sharply* annulate with brown to the very tip, one of the characters given as distinctive for the species in Europe.

MALE GENITALIA: Two figures are given, from material taken at Canard, Kings County (figs. 1, 3), the one showing the lateral position and the other with the claspers spread apart. The sacculus is strongly curved cephalad, and its apex reaches to, or slightly overlaps, the clasper; the terminal area is provided with scattered setae which are more slender than similar ones in *atlantica*; the projection near its base is less prominent than the triangular process of *atlantica* and more rounded apically. The clasper (valve) is variable in size but in general is shorter and broader than in *atlantica* and of more even width throughout. The basal area of the tegumen is decidedly broader than the same section in *atlantica*, and the socii are more heavily chitinized, triangular in shape, and quite prominent. The transtillae are noticeably broader than those of *atlantica*. One of the most constant characters is found in the cornuti of the vesica which are short and thin and very much more closely appressed than those of *atlantica*. The figure given with expanded claspers is a very close match to the genitalia of the British Museum male of *anatipennella*, simply labeled "Europe."

FEMALE GENITALIA: Genital plate broader than high, the sides sloping considerably, and the caudolateral angles rather squarely cut. In this respect the figure given of a Canard, Kings County, specimen (fig. 6) matches excellently Pierce's figure (as *albidella*) and, somewhat less so, the figure of the British Museum specimen in which the angles are slightly sharper, owing probably to a different position in mounting. The two lobes of the plate are very wide apart in the median section and furnished with several strong setae apically. Their ap-

posed edges each show a rather variable number of five or six somewhat thinner setae. The semicircular ostium is strongly raised above the level of the genital plate, and its heavily chitinized cephalic edge reaches close to the cephalic edge of this plate. The ductus bursae is slightly bulbous at its inception, becomes then quite narrow, and is composed of three sections. The first section forms a lightly chitinized tube, the sides of which are weakly strengthened by a thicker area of chitin. Following this is a spiculate section of apparently very variable length and in the Nova Scotia specimens longer than in the two European specimens available for study. The figure given shows a fairly normal condition, but in other specimens this area is still longer at the expense of the length of the first section. The third section is membranous, gradually curves to the right in a partial large convolution, and then twists irregularly, and very variably in individual specimens, straightening out and broadening gradually as it enters the bursa; the convolute section contains a slightly spiculate area from which the ductus seminalis arises. Starting in the distal portion of the first section of the ductus a narrow, median, chitinous band runs through the following two sections, ending in the large convolution, shortly before the exit of the ductus seminalis. The bursa copulatrix is oval and membranous, containing a long, thin, curved signum, which arises from a comparatively large base with rounded margin; the shape of the basal section appears to vary in individuals on account of the position of the bursa on the slides. Such minor differences as occur between the organ of the European specimen and that of the Nova Scotia one in the figures given seem, in the author's opinion, to be hardly sufficient to warrant specific separation, although eventually a subspecific status for the latter form may be considered advisable.

LARVAL CASES: In such cases as were available for study, no satisfactory differences could be found between those found on apple and those on willow. The former resemble closely the figure given by Stainton of the case of *anatipennella* on sloe, even to the pair of slight dorsal protuberances. Generally speaking, the emergence of the adult appears to distort the lateral flaps to a greater or less degree, making a satisfactory comparison almost impossible. The food plants listed for the species in Europe are very varied, including *Corylus*, *Crataegus*, *Prunus*, *Pyrus*, *Quercus*, *Tilia*, *Betula*, and *Alnus*.

REMARKS: In 1933 (Canadian Ent., vol. 65, p. 166, pl. 10, fig. 15) the author listed the occurrence of a single male specimen of *atlantica* bred from a case on *Tilia*; a figure of this was given. The genitalia of the specimen have been available for study and agree excellently with

those of *anatipennella* and not with those of *atlantica*. A change in the determination seems advisable.

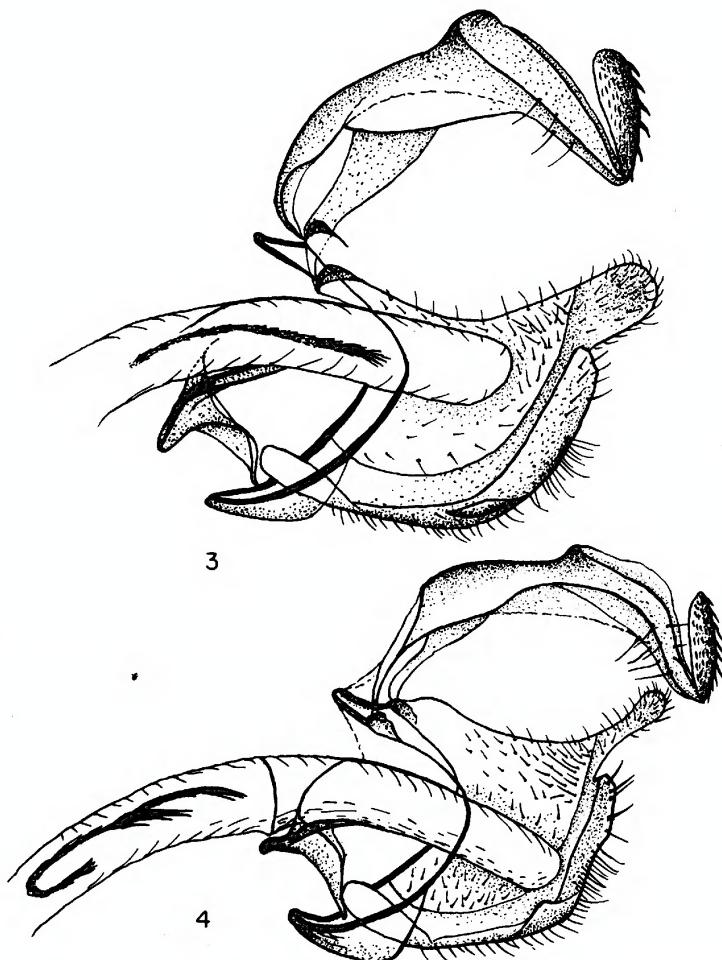
Coleophora atlantica Heinrich

Coleophora atlantica HEINRICH, 1920, Proc. Ent. Soc. Washington, vol. 22, p. 161; 1924, in Forbes, Mem. Cornell Univ. Agr. Exp. Sta., no. 68, pp. 203, 204, 208, 219, figs. 123, 126. McDUNNOUGH, 1936, Canadian Ent. vol. 68, p. 55.

As noted above, certain material from the type series of *atlantica* has been available for study. This has consisted of a slide of the male genitalia of a bred paratype, mounted laterally, and of two paratype females, one collected at Washington, D. C., by A. Busck and now in the Canadian National Collection, the other bred on cherry at East Aurora, New York, and in the author's collection. Slides of the genitalia of both of these have been made, and a figure (fig. 7) of this organ from the Washington female is given. A drawing of the male genitalia was also made before the slide was returned to the United States National Museum. From a careful examination of this slide it appears that Heinrich's figure 123 is not entirely accurate,¹ especially as regards the apical portion of the clasper, which is depicted as being greatly expanded, forming a large, bulbous section on a very narrow neck; such an expansion was not at all evident in the above-mentioned slide.

A study of a number of genitalic slides of both sexes, made from specimens of the willow-feeding species, shows quite conclusively that these specimens should be referred to *atlantica* rather than to *anatipennella*. At the outset of the study it was expected that they would prove to belong to the European *albidella*, which had been restricted by European workers to the pistol-case bearer on *Salix caprea* and its allies, to which *S. bebbiana* of Canada is related. However, while the male genitalia show a very close relationship, certain characters in the female genitalia, mentioned below, prevent such a reference, and in consequence *atlantica* is here considered as having specific rank. Such action, it should be stated, is taken on the supposition that Toll's figure of *albidella* (1952, *ibid.*, pl. 25, fig. 227) is correct, as no specimen of this sex has been available for dissection. The material in the Nova Scotia Museum, mentioned above as having been collected at light,

¹ Since the above was written, information has been received from J. F. Gates Clarke of the United States National Museum, who has kindly examined male genitalic slides of the type series, that, while accurate, this figure was evidently drawn from an aberrant specimen as far as the terminal bulbous expansion of the clasper is concerned. Such expansion was not evident in any of the other material examined.



Figs. 3-4. Male genitalia of *Coleophora*, lateral view with left clasper removed. 3. *C. anatipennella* Hübner. 4. *C. atlantica* Heinrich.

proves on genitalic characters to belong to *atlantica* and a figure is given (fig. 4) from one of the Glenville males, mounted laterally, which agrees very closely with the drawing of the paratype of *atlantica*. To complete the illustrations another figure (fig. 2) of the male genitalia of a Baddeck specimen with claspers opened out is shown, and the female organ (fig. 8) of a specimen from the same locality is given for comparison with that of the Washington paratype. In this connection it should be noted that the occurrence of the large convolution on the left side instead of on the right is simply due to a twisting of the

ductus, which frequently occurs and has no specific value. The following descriptions of genitalia are largely comparative.

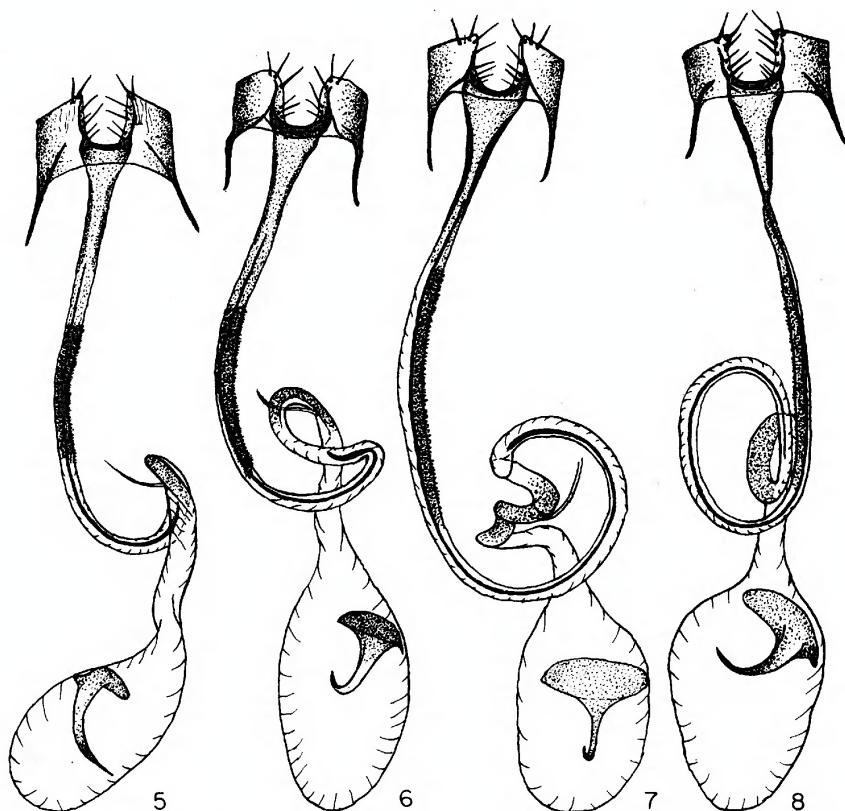
MALE GENITALIA: Similar in almost all respects to those of *albidella*, but differing in the cornuti of the vesica which are much longer and stronger and not nearly so closely appressed; this character also separates the species from *anatipennella* from which the following additional characters offer a means of separation. The basal area of the tegumen is not nearly so broad, and the socii are neither so strongly chitinized nor so triangularly shaped. The apex of the sacculus does not quite reach the base of the clasper, and the marginal setae in this region are much stronger. The projecting process is more prominent and triangularly shaped. The clasper is narrower, with slightly expanded apical section. The transtillae are considerably thinner.

FEMALE GENITALIA: Genital plate much as in *anatipennella*, the caudolateral edges squarely cut in contradistinction to their rounded appearance in *albidella* as figured by Toll. The ductus bursae is divided into the same three sections as in *anatipennella*, but the whole length is considerably greater. The sides of the initial section are much more strongly chitinized, and the spiculate section, although rather variable in length, is still, on the whole, considerably longer. The final membranous section forms distally a much larger and more complete initial convolution, followed by a variably twisted section, partly faintly spiculate, from which the ductus seminalis arises. The base of the signum in the bursa from which a long spine arises is larger.

LARVAL CASES: The single case from the paratype material available for examination matches Heinrich's figure 126 quite satisfactorily. The cases from willow show mostly a slight intermixing of white fluff on the dorsal section, which probably may be attributed to the woolly nature of the willow leaf. The lateral flaps appear small and quite closely appressed, and in general appearance the cases are very similar to those of *anatipennella*. The known food plants are *Prunus*, *Salix bebbiana*, and *Populus*.

In conclusion it should be mentioned that from two quite distinctive pistol cases found on beech in the Halifax area by D. Ferguson a male and a female have been reared. The male specimen agrees quite closely with the original description of *atromarginata* Braun, while the female, the primaries of which are almost entirely suffused with light brown, seems to fall to *albovanescens* Heinrich. The male genitalia are scarcely separable from those of *anatipennella*; the female

genitalia, while showing considerable resemblance in the structure of the genital plate and the ostium, are more distinctive in that the long, thin, chitinous band running through a large portion of the ductus in *anatipennella* is entirely lacking. The cases differ from those of both *anatipennella* and *atlantica*. The angle between the dorsal and apical sections is definitely a right angle, and the dorsal section shows a much more distinct pair of protuberances. They bear a close resemblance to the case figured by the author as *atromarginata* (1933, Canadian Ent., vol. 65, pl. 10, fig. 16). Until more material is available for study, the identity of the species remains doubtful.



Figs. 5-8. Female genitalia of *Coleophora*. 5. *C. anatipennella* Hübner, from Europe. 6. *C. anatipennella* Hübner, from Nova Scotia. 7. *C. atlantica* Heinrich, paratype. 8. *C. atlantica*, from Nova Scotia.